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than *f* or *g*. April 4—Between *e* and *f*. April 21—Between *f* and *k;* nearer to *f*.

S Boötis.

1904. May 2, 16—Invisible.

1905. April 4—Equal to *g;* brighter than *h*. April 27—Brighter than *f* or *g;* equals *e;* less than *c*. May 4, 9—The same (May 7 was the date of predicted maximum). May 19—Between *e* and *c*. May 21—It seems nearer to the luster of *c* than of *e*. July 1—It has sunk to about 11.5 magnitude.

S Ursæ Majoris.

The comparison-stars used for this variable and also for *I Ursæ Majoris* and *S Boötis* are those of the charts published by the Harvard Observatory in 1891.

1904. February 16—Invisible. April 4—Equals *f*. April 17—Equals *g*.

1905. January 9—Very close to the brightness of *d,* perhaps two tenths less; brighter than *g;* less than *c* (night clear). January 24, 27—The same. February 22—Two tenths brighter than *f*. March 26—Equals *h*. April 4—Less than *h* or *l;* of about 11 magnitude. April 21—Not discernible (night hazy).

A four-inch refractor was used for these observations.

San Francisco, December 30, 1905.

TOTAL SOLAR ECLIPSES.

SKETCH OF AN APPARATUS FOR INVESTIGATING THE POSITION OF THE PRODUCING ELEMENTS OF THE SHADOW-BANDS IN SPACE.

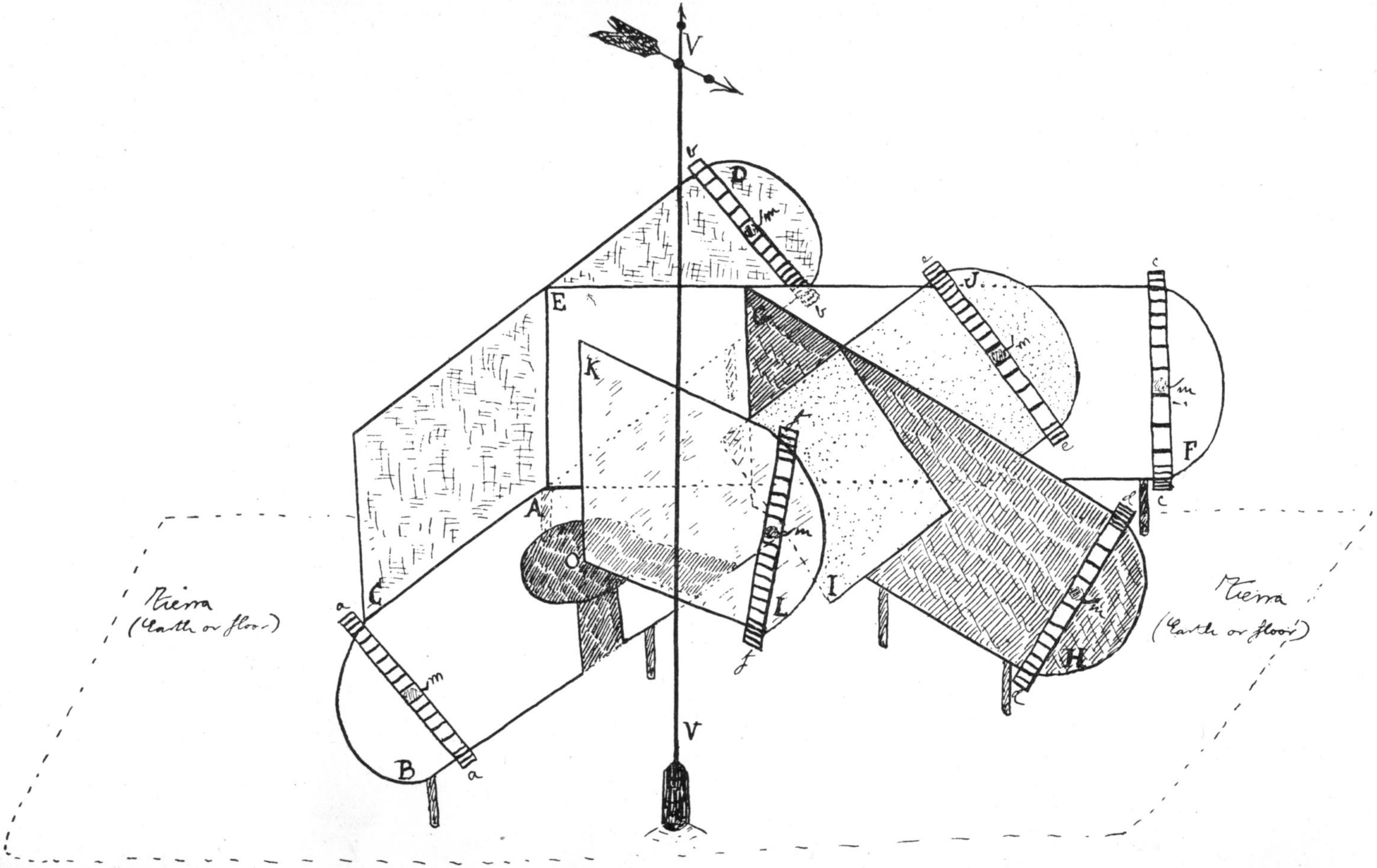
By M. Roso de Luna.

It is known that some moments before and after the total phase of an eclipse we can see sinuous bands sliding along the ground, which alternately are bright and dark. The orientation, direction of movement, speed, etc., of these bands have been studied by means of a white piece of linen laid horizontally on the ground and placed from north to south. From observations thus made Messrs. F. H. BIGELOW and W. H. PICKERING have made important studies as to the possible causes of the phenomenon. I now propose to men of science to conduct the observations in future eclipses by geometrically searching for the position in space of the producing elements of such bands; or, perhaps, they may have a luni-solar origin, owing to the decomposition effected by the edges of the Moon upon the rays of the thin solar sickle at the proximities of totality.

To determine the position of such elements, three different planes with two (one vertical and another horizontal), as per descriptive geometry, would be enough. That is the method followed by us of determining in the eclipse of August 30, 1905, at Soria, Spain, the position of said elements, which were found to be in a plane nearly vertical (88° to 99° in 5 seconds), forming with the observation vertical plane, placed from east to west, an angle less than 45°. From these observations we have deduced the great convenience of employing several other planes on which to mark the traces of the undulating bands, and our apparatus to observe the eclipse in 1912 will be constituted (see figure), first, of a horizontal plane, A B, at the height of the arms of the observer, who will be situated at O; second, the vertical plane, C D, placed from north to south; third, another vertical plane, E F, from east to west; fourth, another, G H, azimuthal to the Sun at the moment of totality; fifth, another, I J, perpendicular to the latter; sixth, another, K L, in the direction of the wind, moved by the weathercock, V, which may be made immovable at the moment of observation. The observer, at O, will mark in all these planes the respective orientation of the bands at least once before and once after the total phase.

In the prolongation of these planes will be placed six observers, who will mark the said orientation of the bands, each in his respective plane, as a check on the observations.

Six other observers will measure the width of the bright parts between the bands by comparison with the respective *scale ribbons aa, bb, cc, dd, ee, ff.* Each of these ribbons is mounted upon two rollers forming an endless chain. The rollers are so mounted that the ribbons may easily be placed perpendicularly to the bands.


V
v
D
m
v
E
J
e
m
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F
m
c
e
K
A
I
L
m
f
f
C
a
m
a
B
H
m
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c
Tierra
(Earth or floor)
Tierra
(Earth or floor)
V

In the linen scale-ribbon are drawn black bands measuring 2^{cm}, separated by increasing series from 2 to 30^{cm}. The zones coinciding in width with the separation-zones will be marked with a pencil between the bands. Two other observers will measure the width of the bands by comparison with a pasteboard with painted bands separated by one half centimeter. Another six could study the coloration of the bands by means of special pasteboards with painted bands in several colors, black, earthy, gray, etc.

With the data of the first seven observers, and the geometrical studies of every two or every three of the six planes, we shall have all the necessary elements to geometrically calculate the position in space of the generating elements of the undulating bands, and we shall be able to advance most confidently conclusions about the true cause of so interesting a phenomenon.

MADRID, September 3, 1905.

PLANETARY PHENOMENA FOR MARCH AND APRIL, 1906.

By MALCOLM MCNEILL.

PHASES OF THE MOON, PACIFIC TIME.

First Quarter,	Mar. 3,	$1^h 28^m$ A.M.	First Quarter,	April 1,	$8^h 2^m$ A.M.
Full Moon,	" 10,	12 17 P.M.	Full Moon,	" 8,	10 12 P.M.
Last Quarter,	" 17,	3 57 A.M.	Last Quarter,	" 15,	12 36 P.M.
New Moon,	" 24,	3 52 P.M.	New Moon,	" 23,	8 6 A.M.

The vernal equinox, the time when the Sun crosses the equator from south to north and spring begins, is on March 21st, 5 A. M. Pacific time.

Mercury is an evening star on March 1st, but is too near the Sun to be seen, setting only a little more than half an hour after sunset. The distance from the Sun increases rapidly; by the middle of the month the planet remains above the horizon more than an hour and a half after sunset, and can be easily seen in the evening twilight for a week or more before and